

of people as either 'us' or 'them', fostering xenophobia and its attendant horrors — Northern Ireland and the Middle East come to mind.

These views are summarized in a wonderfully passionate essay, "Time To Stand Up", written shortly after 11 September, 2001. One excerpt: "To label people as death-deserving enemies because of disagreements about real-world politics is bad enough. To do the same for disagreements about a delusional world inhabited by archangels, demons, and imaginary friends is ludicrously tragic."

Would that there were an afterlife, so that Robert Taylor could smile upon his far more effective heir! As Taylor and his fellow freethinkers knew, atheism in early nineteenth-century Britain was blasphemy and thus illegal: Taylor was twice jailed for his activities. Thankfully, such strictures are now much rarer, but a subtler form of repression prevails in places such as the United States. Scientist-atheists, bowing to prevalent notions of politically correct social inclusiveness, are unwilling to express their opinions for fear of offending religious sensibilities. But Dawkins makes a strong case that most religions are insidious and dangerous illusions. It's time for those who agree to stand up beside him. ■

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The writing on the slate

Nature via Nurture: Genes, Experience and What Makes Us Human

by Matt Ridley

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Andrew Berry

Is who we are determined ineluctably by our biological inheritance or, more malleably, by our experience? The debate is surely as old as human consciousness. In 1874 Francis Galton gave it its modern identity when, borrowing from Shakespeare's villain Caliban, "a devil, a born devil, on whose nature nurture can never stick", he cast the issue in terms of what he called a "convenient jingle of words": nature and nurture.

Having made the distinction, in *Hereditary Genius* Galton then set the tone for the debate to come by hewing dogmatically to an extreme position: "I have no patience with the hypothesis occasionally expressed, and often implied, especially in tales written to teach children to be good, that babies are born pretty much alike, and that the sole agencies in creating differences between

boy and boy, and man and man, are steady application and moral effort. It is in the most unqualified manner that I object to pretensions of natural equality."

The other extreme has also attracted its own inflexible adherents, most notably members of the 'behaviourist' school founded by J. B. Watson, whom Ridley quotes: "Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select: doctor, lawyer, artist, merchant-chief, and yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."

This polarization remains with us to this day: the debate is typically couched in terms of nature versus nurture, implying that these factors are mutually exclusive. The issue is clouded by the difficulty of bringing conclusive evidence to bear. Experiments on humans are impracticable or unethical, although the Moghul emperor Akbar, unfettered by regulations on the use of human experimental subjects, did apparently raise several individuals in total isolation to determine which religion — Hinduism, Islam or Christianity — they would spontaneously embrace. The experiment was inconclusive: the lack of stimulation during their development turned Akbar's unfortunate human guinea-pigs into deaf mutes.

Modern commentators have struggled to extricate themselves from the straitjacket of Galton's dichotomy. Some genes do indeed act independently of the environment: regardless of my lifestyle or where I live, I will inevitably develop Huntington's disease if I carry the disease-causing mutation. And conversely, plenty of our behaviour is largely environmentally determined — that I speak English, not Turkish, is simply a reflection of where I was raised and by whom. But not all behaviour resides at one or other end of the spectrum: genes and the environment often interact such that the either/or categorization of the 'versus' view is misleading.

However, as the evolutionary biologist David Sloan Wilson pointed out in the *New York Times* on 25 February 2003, the rhetorical allure of the extremes remains strong: "Everyone calls themselves an interactionist. Yet often, when you

scratch below the surface, you find a sociobiologist who marginalizes the importance of culture, or a social constructivist who hates the very idea of sociobiology, and they end up painting caricatures of each other. True integrative thinking is in the very early stages."

Nature via Nurture is a book-length exercise in 'integrative thinking': science writer Matt Ridley has produced a paean to interaction that will do much to erode the mutually exclusive view of nature and nurture.

Interaction is best exemplified in a simple idea that typically makes an appearance somewhere near the beginning of a genetics textbook and is then ignored throughout the rest of the book: the outcome produced by a gene may depend upon the context in which the gene is expressed. Citing new work by Darlene Francis at Emory University in Atlanta, Ridley provides an extraordinary and elegant example. C57 and BALB strains of mice differ discretely in some aspects of adult behaviour. But C57 embryos transplanted to BALB uteri and raised by BALB mothers display, as adults, aspects of BALB behaviour; mere cross-fostering (C57 to BALB parent) after birth, however, does not provoke the change, implying that the uterine environment is the critical context. The

C57 genotype expresses C57-typical



behaviour only after development in a C57 uterus.

Ridley's historical tour of several disciplines is a delight: the pivotal players in ethology, neurobiology, anthropology and psychology are brought to life in engaging pen-portraits. We encounter anthropologist Franz Boas in 1884 during his first field season among the Inuit of Baffin Island as he notes in his diary: "These are the 'savages' whose lives are supposed to be worth nothing compared with a civilized European. I do not believe that we, if living under the same conditions, would be so willing to work or be so cheerful and happy." Konrad Lorenz appears both in his best-remembered guise, pursued by a string of adoring ducklings, and in an altogether more sinister one. While working as a military psychologist in Poland in 1942, Lorenz participated in SS-sponsored research designed to distinguish between inferior Polish and superior German characteristics in 'half-breeds'. Nor does J. B. Watson of behaviourism fame fare too well in retrospect: his fall from grace was occasioned by an extramarital love affair, and he ended up, appropriately enough, applying his skills in pavlovian conditioning to advertising Johnson's baby powder. The human detail enriches *Nature via Nurture*, but Ridley by no means subscribes to the modern dumb-it-down school of science writing, in which the science itself becomes a sideshow to the serious business of prying into the scientists' personal lives.

Ridley's book reminds us of the importance of good science writing. Because he is not a professional scientist, Ridley is not stuck deep in a disciplinary trench and has the freedom to range across huge swathes of intellectual territory. In doing so, he has given us a rich overview and a compellingly integrated picture of a great deal of science, both old and new. Make *Nature via Nurture* part of your nurture. ■

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The evolutionary blackbird

The *Story of Life*

by Richard Southwood

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Carl Zimmer

The poet Wallace Stevens wrote about 13 ways of looking at a blackbird. Perhaps someday another poet will write about 13 ways of looking at the history of life. I can certainly think of 13 different scientists who have written books on the subject, each of which is coloured by its author's expertise.



Books by vertebrate palaeontologists are dominated by animals with bones, despite the fact that vertebrates make up a tiny proportion of the world's biodiversity today — not to mention the fact that they didn't exist for the first 3 billion years or so of life's history. The Precambrian expert Andrew Knoll has looked at those first 3 billion years in great detail in his new book *Life on a Young Planet* (to be reviewed in *Nature* shortly), leaving the details of dinosaurs and mastodons to others. For yet another take, try *The Major Transitions in Evolution* by John Maynard Smith and Eörs Szathmáry. For them, the essence of life's history is the emergence of new kinds of complexity. Instead of fossils, you get equations.

In *The Story of Life*, Oxford ecologist Richard Southwood takes his own look at the evolutionary blackbird. Southwood is a leading figure in ecology, thanks to his seminal work on insects and his landmark book *Ecological Methods*. For 18 years he taught an introductory course on the history of life, and out of that experience has sprung *The Story of Life*. Not surprisingly, Southwood sees the history of life in an ecological light, not as a single-file parade of new life forms but as a network of species whose links are being perpetually reworked.

This network first took shape over 3 billion years ago, as early microbes cooperated to harness the energy in their environment. The network grew more complex as animals and other multicellular organisms evolved, and as reefs offered new ecospace for species to colonize. Southwood recounts how dry land was transformed over hundreds of millions of years, as bacterial crusts gave way to forests that offered a new ecospace as vast as that of coral reefs. Over time, ecosystems change like gently tapped kaleidoscopes, Southwood writes, although mass extinctions give them a good shake from time to time.

Southwood displays an impressive sweep

of knowledge about life, from the fauna of hydrothermal vents to the anatomy of plant-eating birds' digestive tracts. For the most part, he has kept abreast of the latest developments in evolutionary research, although from time to time he slips back into comfortable textbook explanations. Describing the great domains of life, for example, he writes: "The Archaeobacteria also fall into two groups, both of which have lifestyles that are very unusual, but which could have been maintained on the ancient earth." These microbes (which are now generally called Archaea, not Archaeobacteria) can indeed be found in strange places, such as geysers and oxygen-free swamps. But they can also be found in ordinary places, such as grassland soil and the open ocean, where they outnumber bacteria. Archaea got a reputation for being bizarre only because scientists discovered their more unusual members first.

A more serious shortcoming in *The Story of Life* is the scant attention paid to DNA, which has revolutionized our understanding of evolution's course. The ecological changes that Southwood details were made possible by changes to genes, and scientists are starting to get some hints of what those changes were, from the promiscuous gene swapping between early microbes to the recruitment of old genes to make new structures such as jaws and fingers.

Despite these grumbles, I recommend *The Story of Life* to those looking for a swift, efficient delivery of the most important information we have on how life has blossomed on Earth. Southwood is succinct and clear, and his narrative rarely gets bogged down with historical digressions or personal anecdotes. Although this style has its strengths, it also has its weaknesses. At the beginning of his book, Southwood claims that the story of life "provides a benchmark for judgments on the environmental problems of today". But when Southwood finally reaches our own age, he seems almost